

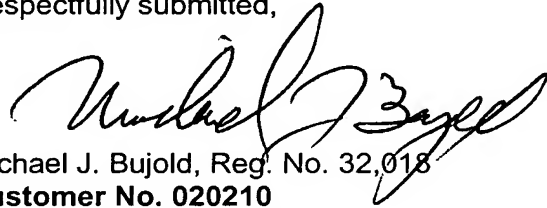
## REMARKS

Accompanying this Preliminary Amendment, please find a substitute specification which overcomes the informalities noted in the original specification. The undersigned avers that the enclosed substitute specification only includes the changes which are indicated on the enclosed marked-up copy of the original specification and does not contain any new subject matter. paragraphs of the specification do not contain any new subject matter.

Newly entered claims 11-18 rewrite the subject matter of amended claims 1-10 in a more traditional U.S. claim format. Please consider the newly entered claims upon consideration of this application.

In the event that there are any fee deficiencies or additional fees are payable, please charge the same or credit any overpayment to our Deposit Account (Account No. 04-0213).

Respectfully submitted,



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[001]

## MACHINE TOOL GEAR MECHANISM

[002]        This application is a national stage completion of PCT/EP2004/010884 filed    ⇐  
September 29, 2004 which claims priority from German Application Serial    ⇐  
Nos. 103 48 757.3 filed October 21, 2003; 10 2004 003 684.5 filed January 24,    ⇐  
2004; 103 48 755.7 filed October 21, 2003 and 10 2004 003 685.3 filed    ⇐  
January 24, 2004.    ⇐

[003]        FIELD OF THE INVENTION    ⇐

[004]        The present invention concerns a machine tool transmission, specifically a  
special spindle transmission according to the preamble of patent claim 1.    ⇐

[005]        BACKGROUND OF THE INVENTION    ⇐

[006]        The invention concerns a spindle transmission with which the strength  
and/or torque transfer from the output shaft of the transmission takes place directly  
on the spindle. The spindle is preferably placed in a co-axial arrangement with the  
output shaft. In the mentioned transmission, the output shaft is directly connected  
to the spindle. The torque proof connection, between the spindle and output shaft,  
can be carried out by positive fitting or by non-positive fitting. From this arises the  
necessity for a transferring device for cooling fluids, oils or air that flow between  
the transmission output and the spindle.

[007]        The described invention tackles this problem based on a machine tool  
transmission, in particular a spindle transmission of the kind specified initially, on  
which the placement of a device for the transfer of cooling fluids, oils or air  
between the transmission shaft and the spindle is intended.

[008]        ~~—— The problem mentioned is solved by the features of patent claim 1.~~    ⇐  
~~Further configurations and advantages can also arise from the patent sub-claims.~~    ⇐

[009]        SUMMARY OF THE INVENTION    ⇐

[010]        Accordingly, a spindle transmission is proposed with which the force and/or  
torque transfer is carried out directly from the transmission output shaft to the  
spindle into which a sealed rotary feed-through is integrated, which serves as the

device for transferring the cooling fluids, oils or air between the transmission output and the spindle.

[011] This type of transmission normally includes a two stage planetary gear and a corresponding switching device, so that a rotational speed difference is developed between the motor shaft and the transmission output. For this reason, according to the invention, a dynamic sealing regulator is envisioned for the admission of the volume quantities and resulting pressures.

[012] In the framework of a preferential execution form of the described invention, the sealed rotary feed-through is supported in the output shaft and includes two gaskets which serve as sealing regulators and as the admission device for the rotational speed difference. Depending on the medium, on the existing pressure and on the volumetric flow, the gaskets can be made of different materials and can have different geometries.

[013] In accordance with a favorable development of the invention, the sealed rotary feed-through includes a spring that compresses the gaskets together, leading to little or no leakage in the gaskets if the medium pressure increases. If there is no medium flow, gasket wear can be minimized by moving the two gaskets away from each other with the help of a device such as another spring, for example.

[014] According to the invention design, the sealing regulator is shifted outside of the transmission, resulting in the benefit that any allowed leaks can be led back directly into a tank. With a solution according to the state of the art, the sealing regulators must seal 100% since, otherwise, the transmission oil would be contaminated, for example with cooling fluid, leading to a malfunction of the transmission.

[015] The invention is exemplified in a more detailed basis in the attached Figure, which shows a schematic cutaway view of a preferential configuration of the transmission in accordance with the described invention. Planetary gears as they are usually installed in a machine tool transmission, in particular in a spindle transmission, are well known by those skilled in the art, for example as in the Applicant's EP 1 169 582 B1. The spindle transmission shown in the Figure

includes a planetary gear, which is also applicable in further types of transmissions which are considered the state of the art.

[016]        BRIEF DESCRIPTION OF THE DRAWING

[017]        The invention will now be described, by way of example, with reference to the accompanying drawing in which:

[018]        The sole Figure diagrammatically shows a schematic cutaway view of a preferential configuration of a spindle transmission.

[019]        DETAILED DESCRIPTION OF THE INVENTION

[020]        The Figure shows a spindle transmission 1, which includes a drive shaft 2, an output shaft 3 and a two stage planetary gear arranged in the force flow direction between the drive shaft 2 and the output shaft 3. The planetary gear features a sun gear 4 connected with the transmission shaft 2, an internal gear 5 mounted in an internal gear housing 6 and a planetary pinion cage 7 with planetary gear 8, connected with the drive shaft 2, which form the output of the planetary gear.

[021]        The switching unit of the transmission is formed by a solenoid 9, which actuates a shift fork 10 that can be relocated by an actuating shaft 11. The output shaft 3 is supported by bearings 13, 14 which are placed in a bearing housing 12 where it is connected with a spindle 15.

[022]        In accordance with the invention, a sealed rotary feed-through is integrated into the transmission 1, which serves as the fluid transfer device for the flow of cooling fluids, oil or air between the transmission output 3 and the spindle 15.

[023]        The sealed rotary feed-through is supported in the output shaft 3 and includes two gaskets 16, 17 which serve as sealing regulators and as the take up mechanism for the rotational speed difference. Gasket 16 is hereby intended to be the gasket on the engine side and gasket 17 is intended to be the spindle side gasket.

[024]        According to the Figure, the engine side gasket 16 is connected by a tube 18, the sun gear 4 and a hub 19 with the engine shaft and/or drive shaft 2.

The spindle side gasket 17 is directly placed in the spindle 15 or in an additional connecting part, for example in a clutch.

[025]        The housing of the sealed rotary feed-through must preferably be supported by one or multiple bearings similar to a bearing 20, which can be ball bearings, roller bearings, friction bearings or hydraulic bearings. As can be seen in the Figure, the sealed rotary feed-through is formed by a check valve 21, which prevents pipe 18 from running dry and the connection lines from being operated without pressure.

[026]        In the context of the configuration represented in the Figure, the sealed rotary feed-through includes a spring 22, which presses the gaskets 16,17 together. In direct gear (1 to 1 ratio) there is no rotational speed difference present at the sealing regulator, however, the rotating gaskets 16, 17 must keep the same static sealing.

[027]        Since the configuration of the sealing regulators, according to this invention, allows for leaks outside of the transmission, at least one leakage return flow 23 to a tank must be provided.

Reference numerals

- |    |                          |
|----|--------------------------|
| 1  | transmission             |
| 2  | drive shaft, motor shaft |
| 3  | output shaft             |
| 4  | sun gear                 |
| 5  | internal gear            |
| 6  | internal gear housing    |
| 7  | planetary pinion cage    |
| 8  | planetary gear           |
| 9  | solenoids                |
| 10 | shift forks              |
| 11 | actuating shafts         |
| 12 | bearing housing          |
| 13 | bearing                  |
| 14 | bearing                  |
| 15 | spindles                 |
| 16 | engine side gasket       |
| 17 | spindle side gasket      |
| 18 | pipes                    |
| 19 | hubs                     |
| 20 | bearing                  |
| 21 | check valves             |
| 22 | springs                  |
| 23 | leakage return flow      |